

On the Occurrence of Protohydra in England.

By

Sydney J. Hickson, F.R.S.,

Manchester.

THE *Protohydra leuckartii* is a minute, solitary hydrozoon (about 3 mm. in length when fully extended), entirely devoid of tentacles and known to increase rapidly in numbers by simple transverse fission.

It was discovered fifty-two years ago by Greeff (1) in an oyster park at Ostend. For twenty years after its original discovery it was searched for in vain, but at last, in the autumn of 1891 and the spring of 1892 (fide Chun (2)), it was rediscovered in the same locality. There is no record of the occurrence of *Protohydra* in any other locality than Ostend, nor is there any record, so far as I am aware, of its occurrence at Ostend since the spring of 1892.

Four years ago, however, my friend Mr. Herbert Ashby found *Protohydra leuckartii* in great abundance in the pools on the tidal marshes of the river Hamble near Southampton, and thanks to his kindness and scientific spirit I have had the opportunity of observing it alive and studying its structure during several months of each succeeding year.

Our present knowledge of *Protohydra* is based on the observations recorded by Greeff, and the more detailed accounts of the minute structure of specimens, collected and preserved by Greeff, which have been published by Chun (2) and Aders (3). But notwithstanding the careful investigation of the material at their disposal by these three observers we are still in complete ignorance of the sexual method of reproduction in *Protohydra*, and it has been in the hope of discovering how and when this important little hydrozoon

produces its ova and spermatozoon that Mr. Ashby and the present writer have continued our observations during the past four years.

This paper is, alas, in this respect only a record of failure. No sexual cells and no method of reproduction—other than by simple transverse fission—have so far been discovered in any month of the year in which we have found Protohydra alive in the pools.

But in view of the importance of the subject of investigation it has been decided to publish a few notes at once on the natural conditions under which Protohydra was found to be living in this country and the method of its capture, in order that the chances of making the next important contribution to our knowledge of the genus may be shared by others equally with ourselves.

The pools in the tidal marshes of the Hamble river where Protohydra is found are very variable in size but in general of a round shape, a few feet in diameter and not more than four or five inches deep. They are flushed with fresh estuarine water only at spring tides. Between the pools there is a rich vegetation in which during the summer months sea-lavender and spartina grass are predominant features. The water in the pools is usually clear, but is sometimes covered with a bacterial film, and the bottom has a colour like iron-rust due to a continuous thin crust of diatoms. When this crust is disturbed a fine black mud is revealed which has a foul marshy smell, particularly in the summer months. Protohydra lives in this diatom crust, the oral end browsing over the surface for food, the aboral end fixed to the mud just below the crust.

As stated above, when fully expanded, Protohydra does not exceed 3 mm. in length, but the moment it is disturbed it contracts into spherical shape less than $\frac{1}{2}$ mm. in diameter. In consequence of its very small size and of its pale orange colour, which closely resembles the colour of the crust, it is very difficult to observe on the marsh. The only way to be certain whether Protohydra is present or not is to scrape up

carefully with a tea-spoon some of the crust, put it into a bottle with marsh-water, allow it to settle in a shallow glass dish for twelve to twenty-four hours, and when a new crust of diatoms has formed in the dish to examine this new crust with a lens.

The bottles containing this mud and water have been sent to Manchester from time to time, and the Protohydra kept under observation in the laboratory without a fresh supply of water for periods of five or six weeks.

A very important feature in the life-history of Protohydra is that in the months of July and August it undergoes some change of habit by which it has entirely evaded our observation. We have never found, notwithstanding most careful search, any trace of Protohydra during these two months.

Greeff found Protohydra at Ostend in September, 1868, in the autumn (Herbst) of 1891 and the spring of 1892. As he failed to find it for twenty years after 1868 and there is no record of his having obtained it in the summer months of any year, his observations in this respect are probably not inconsistent with our own. The disappearance of Protohydra in July may be due to one of three possible causes: it may undergo contraction and encystment or it may produce protected eggs which remain dormant until the autumn, or it may give rise by gemmation or fission to sex-bearing medusæ or floating bodies. If it be due to either of the first two causes the summer stages of Protohydra will undoubtedly be extremely difficult to find in the thick black mud of the pools. To test the possibility of the third cause Mr. Ashby and the writer selected a time just before the onset of the full spring tides towards the end of July this year (1919), and made a careful investigation of the plankton of several pools with a fine tow-net of millers' bunting. We found no medusæ, and, we may add, no evidence of any species of the Cœlenterata in the pools or marshes.

In a problem of this kind there are many methods of attack and we have by no means abandoned the investigation. Still more careful observation of the habits of the animal at

different times of the year and a more careful search of the black mud in the summer will be made in the hope of eventually solving the mystery. But the publication of these notes may induce others to search localities with similar conditions to those of the Hamble river and thereby extend our knowledge of the distribution of the species.

A few words may be added here on the constituents of the fauna and flora of the pools. The most abundant of the diatoms that form the thin crust on the mud is *Pleurosigma balticum*. During the greater part of the year the orange-coloured species of *Dinophilus* (*D. tæniatus*) occurred but was especially abundant in the spring. In July *Dinophilus* entirely disappears as it does elsewhere at that time of year. In the spring we found large numbers of *Gromia oviformis* and an abundance of ciliate infusoria (including *Uronychia* sp.? and *Actinotricha saltans*). Small Harpacticid Copepoda seem to be present at all times of the year and so are immature forms of a species of Nematode worm. There is the common shore crab, *Carcinus mœnas*, in great numbers on the marshes, and in July we found in the pools a late post-larval stage of *Palæmonetes varians*, and, swimming rapidly on its back like an *Apus*, the estuarine Isopod, *Exosphæroma rugicauda* Leach. The writer is indebted to Dr. Tattersall for kindly identifying these species of Crustacea. In the spring we found a few specimens of *Paranais litoralis*. This species is abundant together with *Hemitubifex* and *Haplobranchus* in the pools of the mud-flats at Sheerness, where it was recognised by Sir Ray Lankester in 1887 and described and figured by Sir Alfred Bourne in this Journal, vol. 32, n.s. The only Mollusca we have observed are *Paludestrina stagnalis* Baxter (i. e. *Hydrobia ulvæ* Pennant) and a few specimens of an unidentified Nudibranch.

This short summary of the living organisms of the pools in which *Protohydra* is found is sufficient to indicate that the fauna and flora are typically estuarine in character, and as there is nothing very exceptional or remarkable about them,

it seems highly probable that Protohydra will be found in many other estuaries of the British Isles. The best months of the year in which to look for it are probably April and May when it is most actively increasing in numbers by transverse fission. The worst time to look for it is during the months of July and August.

Protohydra is carnivorous but we have not observed the way in which its food is caught. Greeff describes and gives a figure of a specimen that had devoured a Copepod larger than itself. We have also found specimens which had swallowed the Harpacticid Copepoda that abound in the water, and we have a preparation of another specimen that had ingested one end of a Nematode worm.

There can be no doubt that the small and microscopic fauna is not so rich in July as it is in the winter and the spring, but as the Harpacticids and Nematodes are abundant all the year round and these are the only organisms that have been observed to be the prey of Protohydra, it does not seem probable that the shortage of food is the cause of its disappearance in the summer. The pools do not dry up even at the end of neap tides in the hottest summer months, so that the aestivation is not apparently a provision against drought. The higher temperature of the pools and the increased foulness of the mud may possibly afford the explanation of the phenomenon, but the extraordinary resistance that Protohydra shows to the conditions of living for weeks in a shallow dish in a laboratory without a change of water does not lend this explanation very strong support.

ADDENDUM.—Since the above was written Miss Lebour informs me that Protohydra has also been discovered by Mr. Baker up the Laira river near Plymouth. This discovery confirms our belief that this interesting and probably archaic Cœlenterate is probably a very common form in suitable estuarine conditions.

REFERENCES.

1. R. Greeff.—'Zeits. f. wiss. Zool.,' xx, 1870, p. 37.
2. C. Chun.—Bronn's 'Klassen u. Ordnungen,' Bd. ii, "Cœlenteraten," 1894, p. 217.
3. W. M. Aders.—'Zool. Anzeig.,' xxvi, 686, 1902, p. 33.